Neabsco Creek
Total Maximum Daily Load Study

Technical Advisory Committee Meeting
Woodbridge, Virginia
June 19, 2007

Meeting Agenda

- **Water Quality Assessments and TMDL Process**

  Katie Conaway, VA Department of Environmental Quality

- **Overview of the Load Duration TMDL for Neabsco Creek**

  Bryant Thomas, VA Department of Environmental Quality

- **Questions**

Why are we here?

- **Learn about water quality in Neabsco Creek**
- **Explain efforts that Virginia is undertaking to improve and protect water quality.**
- **Learn what you can do to help.**

How do we know if water bodies in Virginia are healthy?

- **Perform physical and chemical monitoring on water bodies throughout the state.**
- **Monitor parameters such as:**

  - **pH**
  - **Temperature**
  - **Dissolved Oxygen**
  - **Health of Biological Community**
  - **Bacteria**
  - **Nutrients**
  - **Fish Tissue**
  - **Metals/Toxic Pollutants**

What do you do with the monitoring data that is collected?

Compare the data collected to the water quality standards.

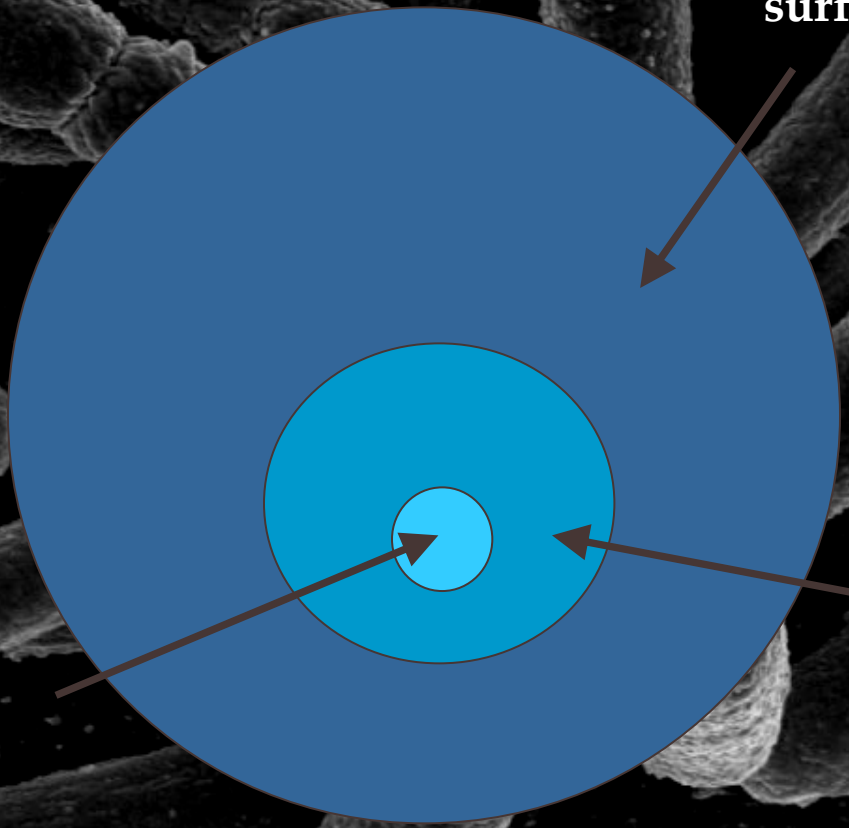
Water Quality Standards:

- **Regulations based on federal and state law.**
- **Set numeric and narrative limits on pollutants.**
- **Designed to protect the following Designated Uses:**

- **Recreational**
- **Aquatic Life**
- **Public Water Supply**
- **Wildlife**
- **Fish Consumption**
- **Shellfish**

What are Fecal Coliform Bacteria and *E. Coli* Bacteria?

Coliform Bacteria:
Commonly found in soil, decaying vegetation, animal feces, and raw surface water.



Fecal Coliform:
- **Found in the digestive tract of humans and warm blooded animals.**
- **Indicator of the potential presence of pathogens in water bodies.**

Escherichia coli:
- **subset of fecal coliform bacteria.**
- **Correlate better with swimming associated illness.**

What is the Water Quality Standard for Bacteria?

Indicator	Status	Instantaneous Maximum (cfu/100mL)	Geometric Mean (cfu/100 mL)
Fecal Coliform	Old	1,000	200
E. coli	New	235	126
Fecal Coliform	Interim	400	200

- **Changes went into effect on January 15, 2003**
- **Both New *E. coli* and Interim Fecal Coliform criteria apply**
- **Fecal coliform criteria will be phased out entirely once 12 *E. coli* samples have been collected or after June 30, 2008**
- **In order for a water body to be listed as impaired:**
  - There must be at least two samples that exceed the water quality criterion.
  - Greater than 10.5% of the total samples must be exceedances.

Potential Sources of Fecal Coliform Bacteria

What happens when a water body doesn't meet water quality standards?

- **Waterbody is listed as "impaired" and placed on the 303(d) list.**
- **Once a water body is listed as impaired, a Total Maximum Daily Load value must be developed for that impaired stream segment.**

What is a TMDL ?

Total Maximum Daily Load

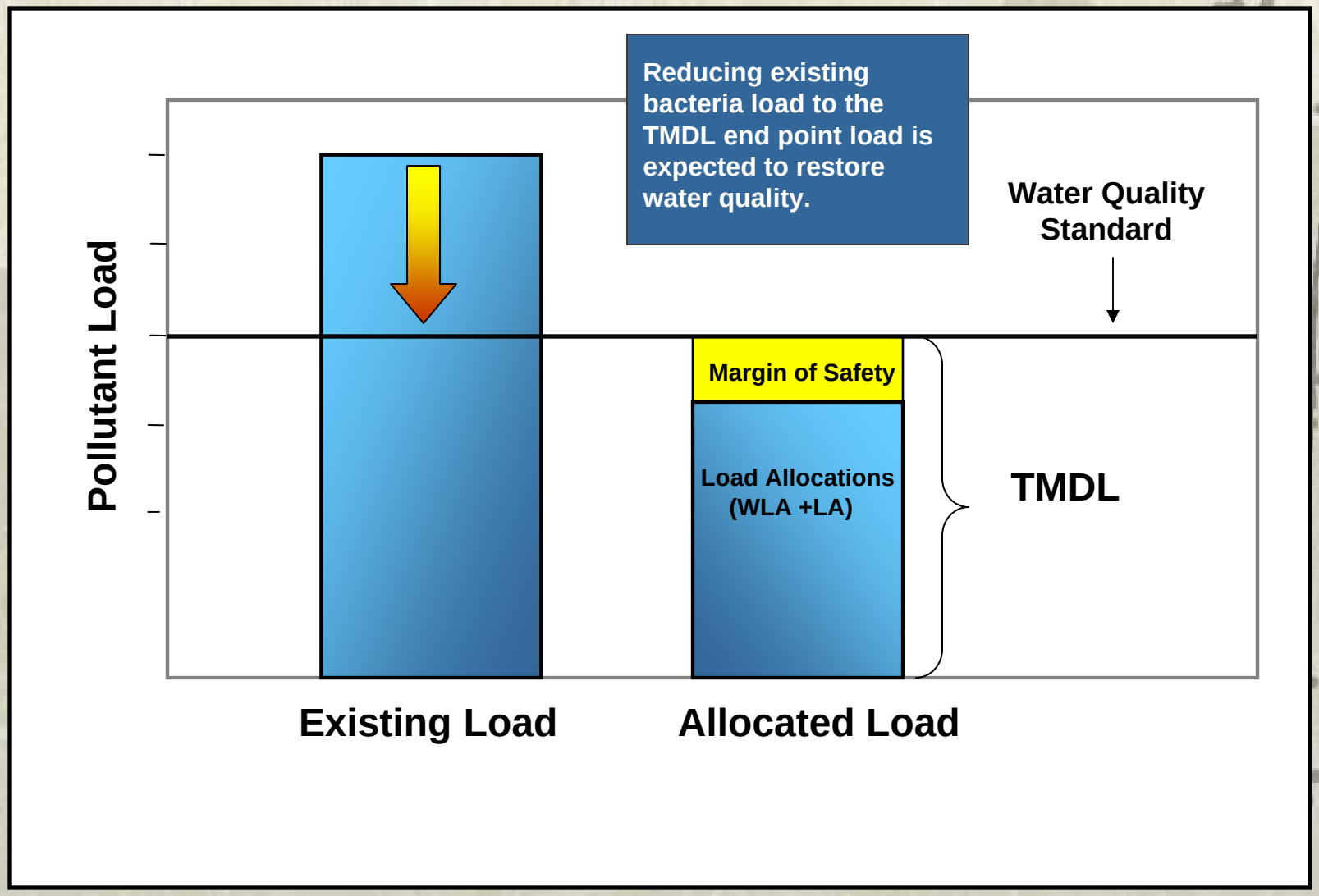
TMDL = Sum of WLA + Sum of LA + MOS

Where:

TMDL = Total Maximum Daily Load
WLA = Waste Load Allocation (point sources)
LA = Load Allocation (nonpoint sources)
MOS = Margin of Safety

A TMDL is the amount of a particular pollutant that a stream can receive and still meet Water Quality Standards.

An Example TMDL



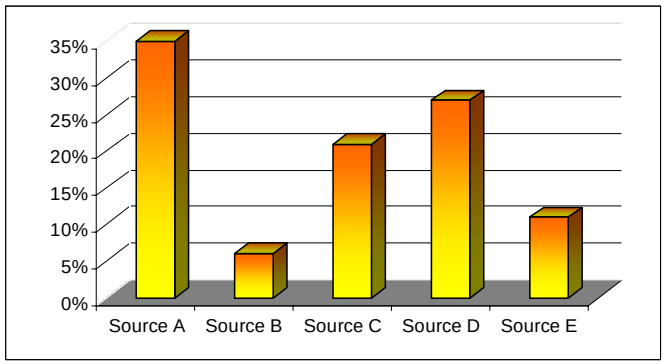
Required Elements of a TMDL

A TMDL must:

- Be developed to meet Water Quality Standards.
- Be developed for critical stream conditions.
- Consider seasonal variations.
- Consider impacts of background contributions.
- Include wasteload and load allocations (WLA, LA).
- Include a margin of safety (MOS).
- Be subject to public participation.
- Provide reasonable assurance of implementation.

We are here

TMDL Study

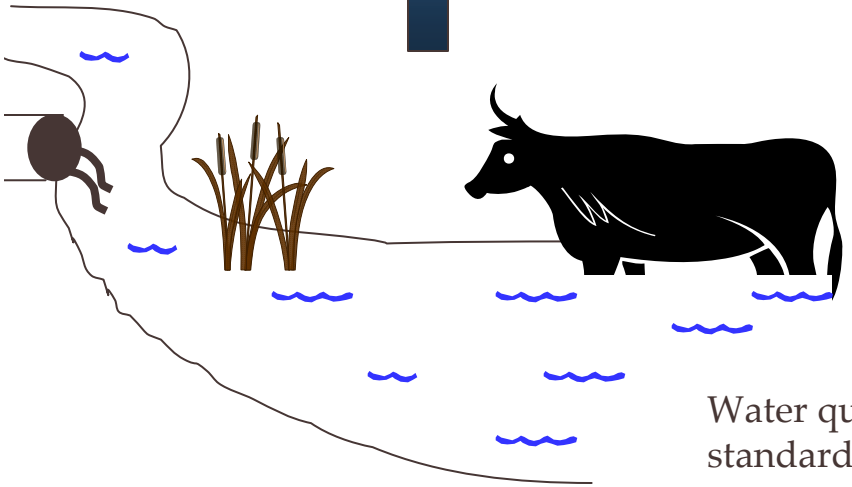


Implementation Plan

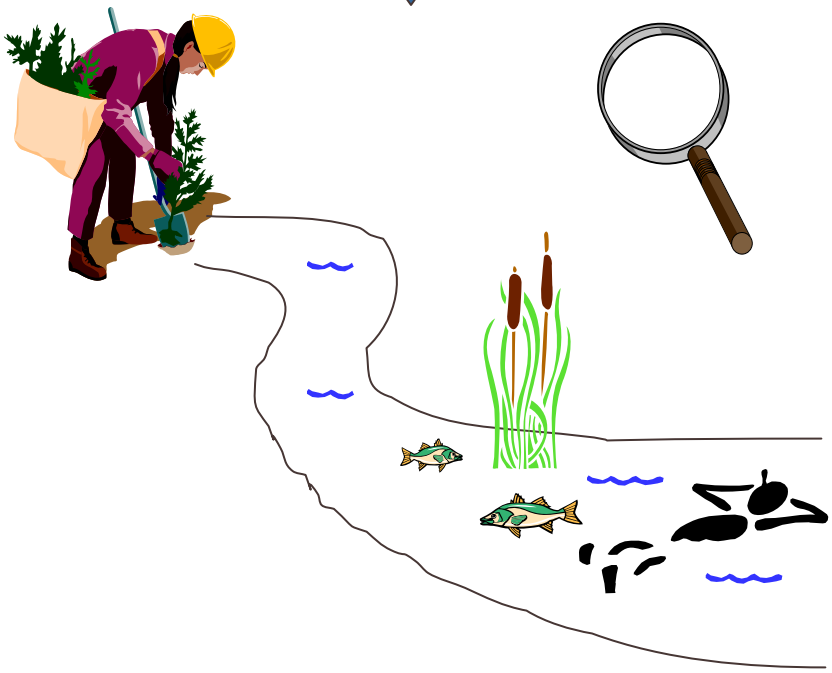
DCR

Implementation

Monitoring



Water quality standards not met



What does this mean for Neabsco Creek?

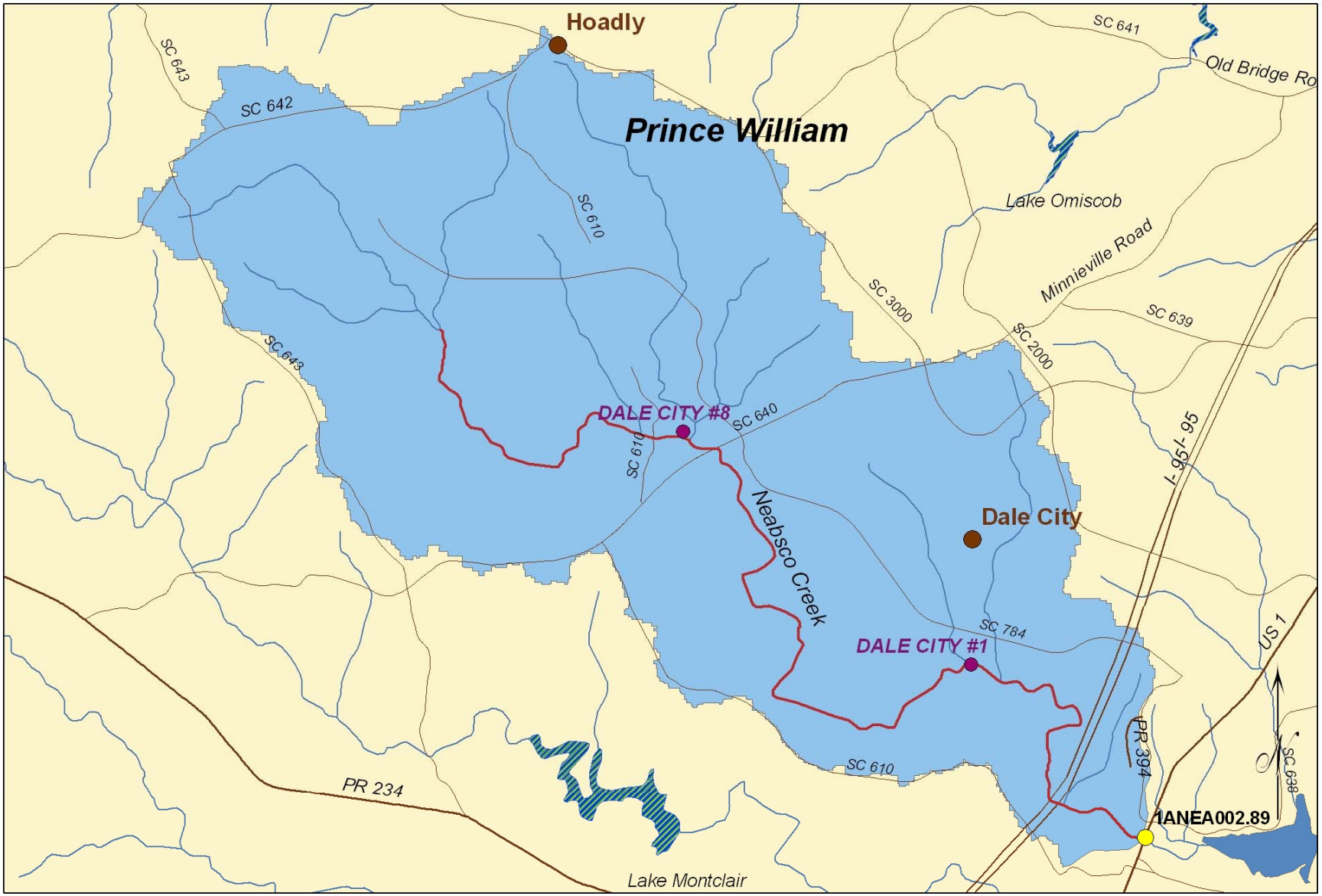
- TMDL study is being done for the non-tidal portion of Neabsco Creek
- Does not meet the Recreational Use – exceeds the water quality standards for Fecal Coliform and E. Coli Bacteria.

Stream Name	Locality	Impairment	Length (miles)	Upstream Limit	Downstream Limit
Neabsco Creek	Prince William County	Bacteria	8.42	Confluence with an unnamed tributary to Neabsco Creek, near Dale City and approximately 0.4 rivermile downstream from Route 784 (on the tributary)	Start of the tidal waters of Neabsco Bay (just downstream from the Route 1 Bridge Crossing)

Fecal Coliform and E. Coli Exceedance Rates for Neabsco Creek

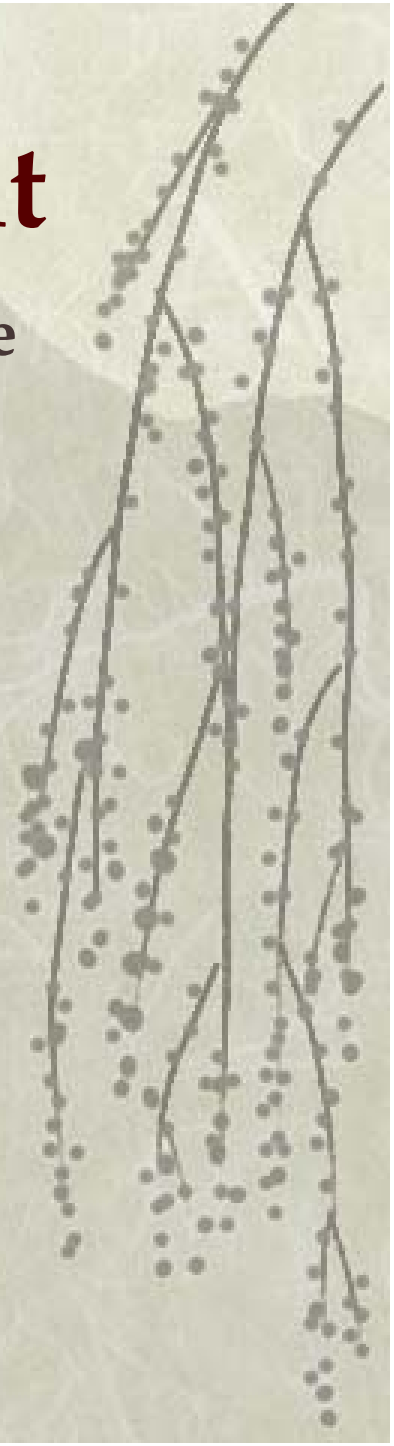
Monitoring Station	Station Location	Fecal Coliform Exceedance Rate Recorded for the 2006 Assessment (01/01/2000 – 12/31/2004)
1ANEA002.89	Route 1 Bridge	5 of 17 samples (29%)

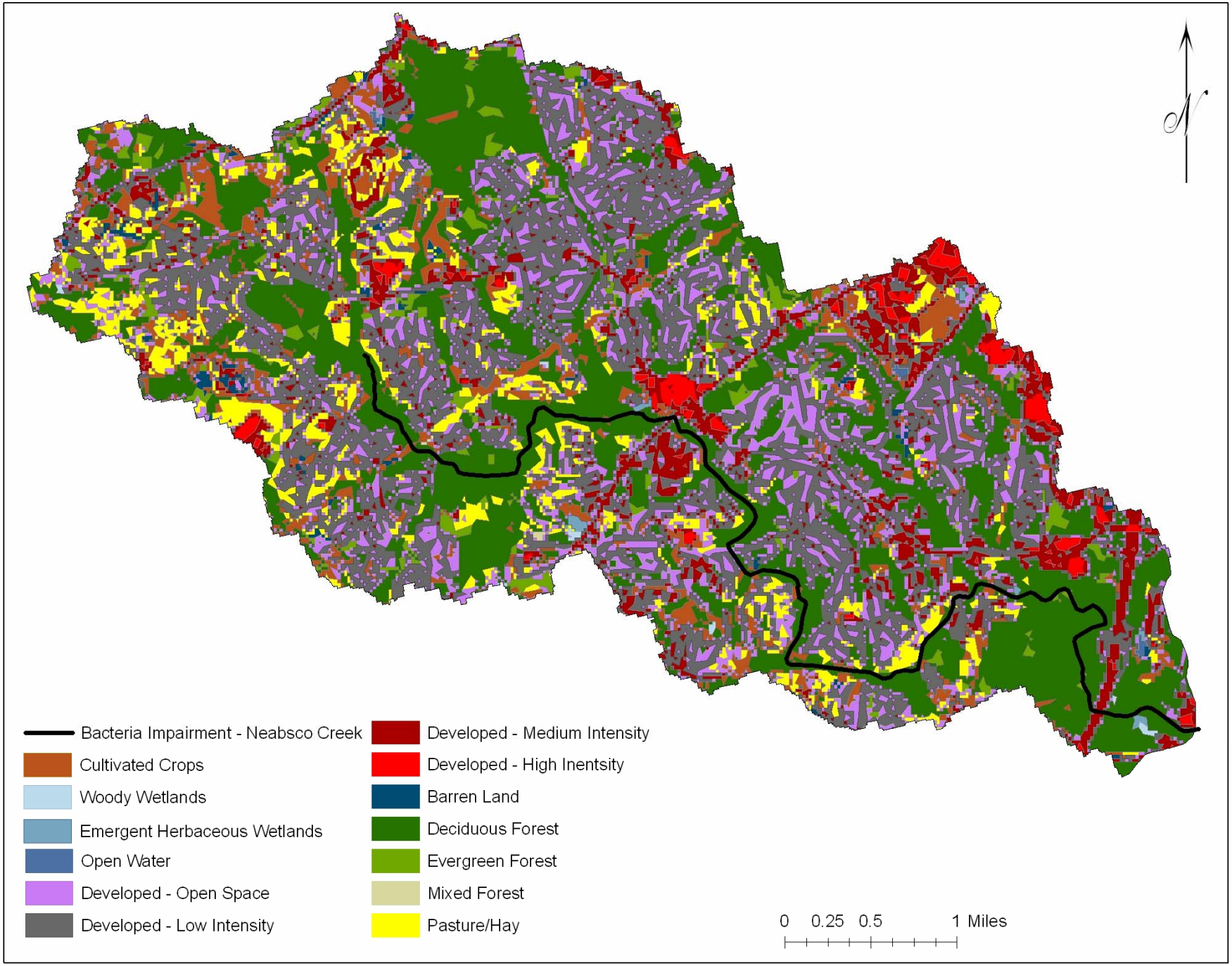
Monitoring Station	Station Location	Bacteria Exceedance Rates Recorded for 01/01/2001 – Current	
		Fecal Coliform	e. coli
1ANEA002.89	Route 1 Bridge	3 of 14 (21%)	2 of 14 (14%)


Hoadly
Prince William
SC 643
SC 642
SC 610
SC 641
Old Bridge Ro
Lake Omiscob
Minnieville Road
SC 3000
SC 2000
SC 639
SC 643
DALE CITY #8
SC 640
SC 610
Neabsco Creek
Dale City
I-95
SC 784
DALE CITY #1
US 1
PR 394
SC 638
SC 610
PR 234
1ANEA002.89
Lake Montclair
DEQ Listing Station
Permitted Point Sources
Bacteria Impairment - Neabsco Creek
Towns
Highways and Roads
Lakes and Reservoirs
Streams and Rivers
Neabsco Creek Watershed
Prince William County

Watershed Assessment

- Investigate potential sources of bacteria in the watershed:
  - Human Sources
    - Permitted Point Sources
    - Straight Pipes
    - Failing Septic Systems
    - Biosolids
  - Pets
  - Livestock
  - Wildlife




Bacteria Impairment - Neabsco Creek
Cultivated Crops
Woody Wetlands
Emergent Herbaceous Wetlands
Open Water
Developed - Open Space
Developed - Low Intensity
Developed - Medium Intensity
Developed - High Inentsity
Barren Land
Deciduous Forest
Evergreen Forest
Mixed Forest
Pasture/Hay
0 0.25 0.5 1 Miles

Permitted Point Sources

Virginia Pollutant Discharge Elimination System (VPDES)

VPDES Permit Number	Facility Name	Maximum Permitted Design Flow (Million Gallons/Day)
VA0024678	Dale Service Corporation - Section 8	4.6
VA0024724	Dale Service Corporation - Section 1	4.6

Municipal Separate Storm Sewer System (MS4) Permits:

MS4 Permit Number	MS4 Permit Holder	Permit Type
VA0088595	Prince William County	Phase I
VAR040100	Prince William County Public Schools	Phase II
VAR040095	Northern Virginia Community College	Phase II
VAR040062	VDOT - Northern Urban Area	Phase II

Human Loading Estimates

- Straight Pipes
  - None estimated in the watershed.
- Failing Septic Systems
  - Estimated that around 250 homes in the Neabsco Creek watershed are still using septic systems
  - Of those 250 homes, none are within 200 feet of Neabsco Creek
  - Thus, most likely very little influence from failed septic systems.
- Land Application of Biosolids:
  - None applied in the Neabsco Creek Watershed since 1975.

*Information on straight pipes, failing septic systems, and biosolids comes from the Virginia Department of Health. Meehan, John, personal communication, June 2007.

Pet Loading Estimates

- Estimated number of households in Neabsco Creek watershed in 2006[1]: 45,995
- Pet Population[2]:

  .543 dogs per household

  .598 cats per household
- Estimated Pet Population in Neabsco Creek Watershed:

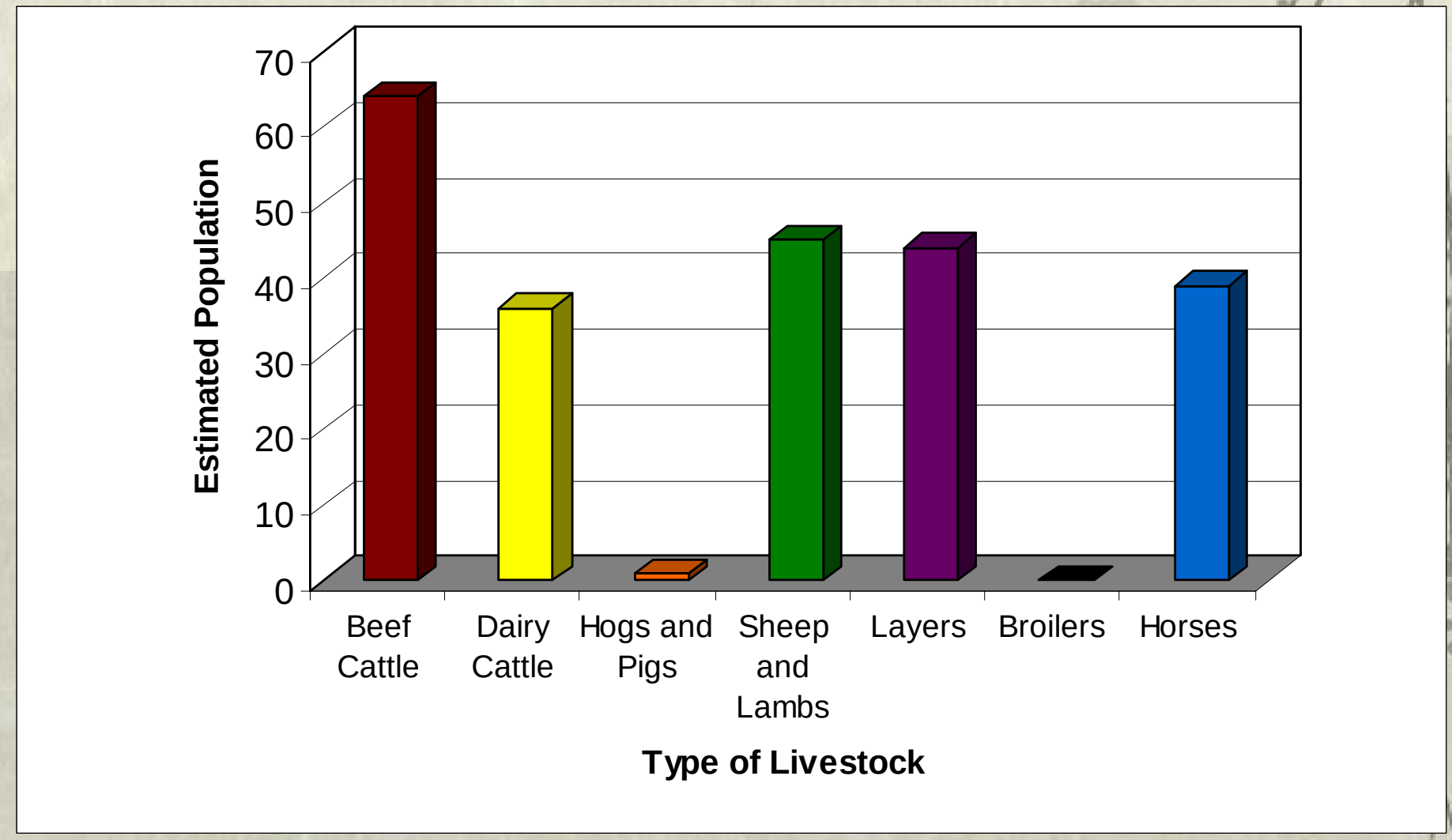
  Dogs = 24,975

  Cats = 27,505

[1]Estimated number of households derived from 2000 Census Data

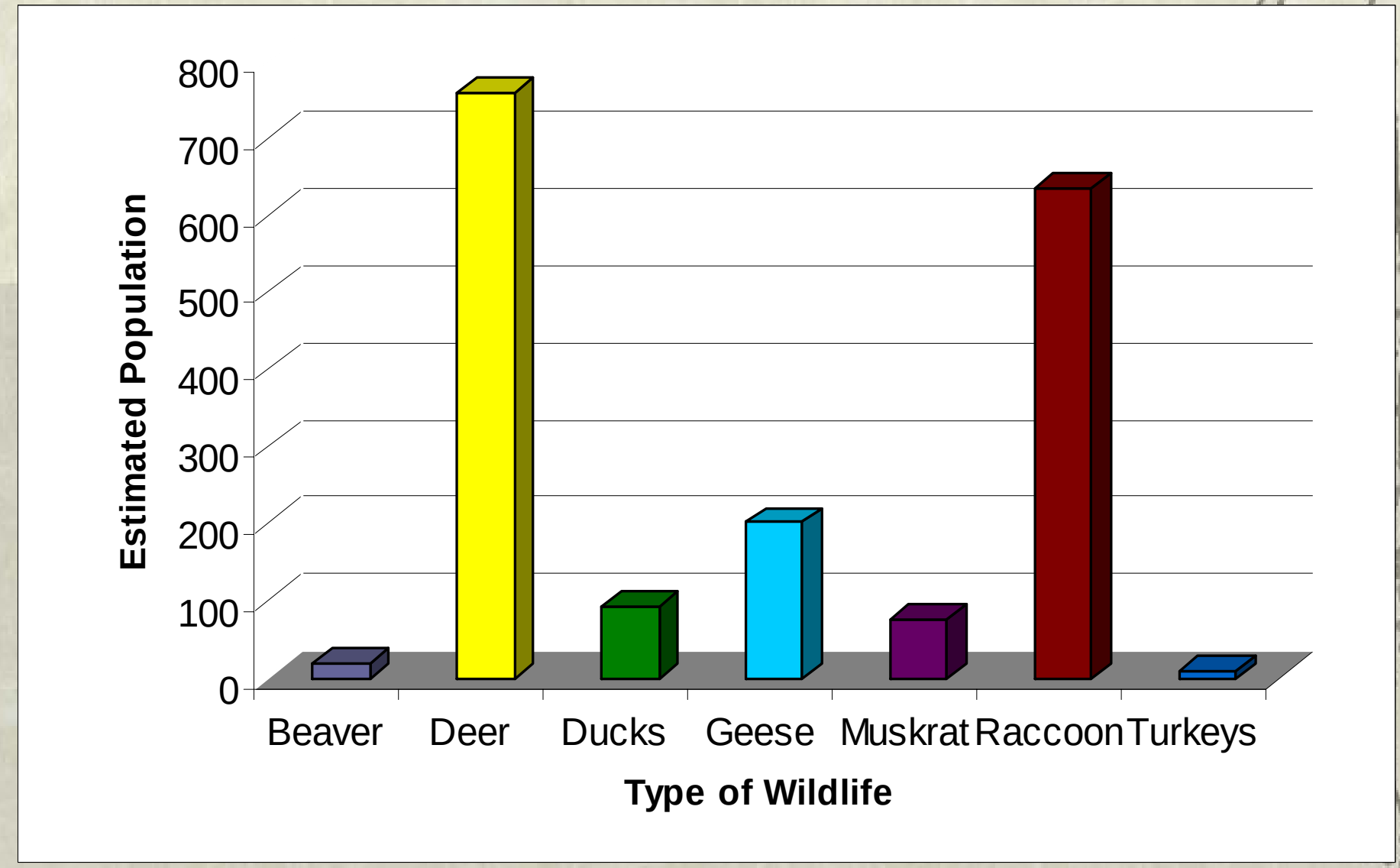
[2]Estimated Number of cats/dogs per household comes from the American Veterinary Medical Association and the Occoquan Streams Bacteria TMDL (2006)

Livestock Estimates in Watershed



*Livestock numbers were estimated using the 2002 USDA Census of Agriculture
http://www.nass.usda.gov/Data_and_Statistics/Quick_Stats/

Wildlife Estimates in Watershed



*Wildlife estimates were derived from population density numbers obtained from the Virginia Department of Game and Inland Fisheries (DGIF)

Technical Approach for Developing the Neabsco Creek TMDL

- Use the Load Duration Approach
- Load Duration Approach:
  - Less complex, spreadsheet model for TMDL development
  - Approach used for bacteria TMDLs
  - Requires the following data:
    - stream flow data
    - ambient water quality data
    - Bacteria Source Tracking analysis for pollutant source identification and quantification

Why do a "Load Duration" TMDL?

- Save time and money
  - Less complex model allows Virginia to develop bacteria TMDLs cheaper and faster as required by the consent decree schedule
- TMDL will be based on actual in-stream measurements bacteria and flow
- BST has gained widespread acceptance by the public, facilitating implementation

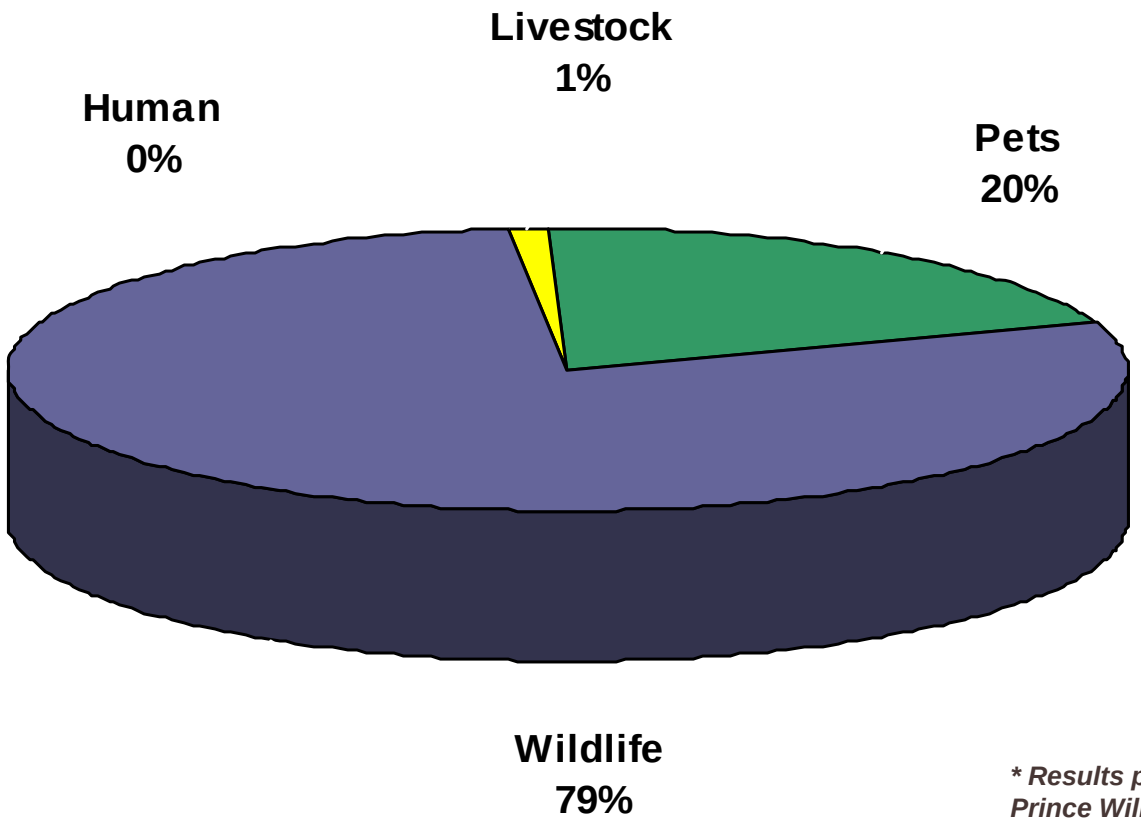
Bacteria Source Tracking (BST) Antibiotic Resistance

- Bacteria from different animals have different patterns of antibiotic resistance seen in the analysis
- These patterns allow the clustering of animals into groups such as human, livestock or wildlife
- BST data have been collected by both Prince William County and DEQ.
- BST results will be used to divide the total allowable load into allocations to each of the contributing sources

Source Contribution

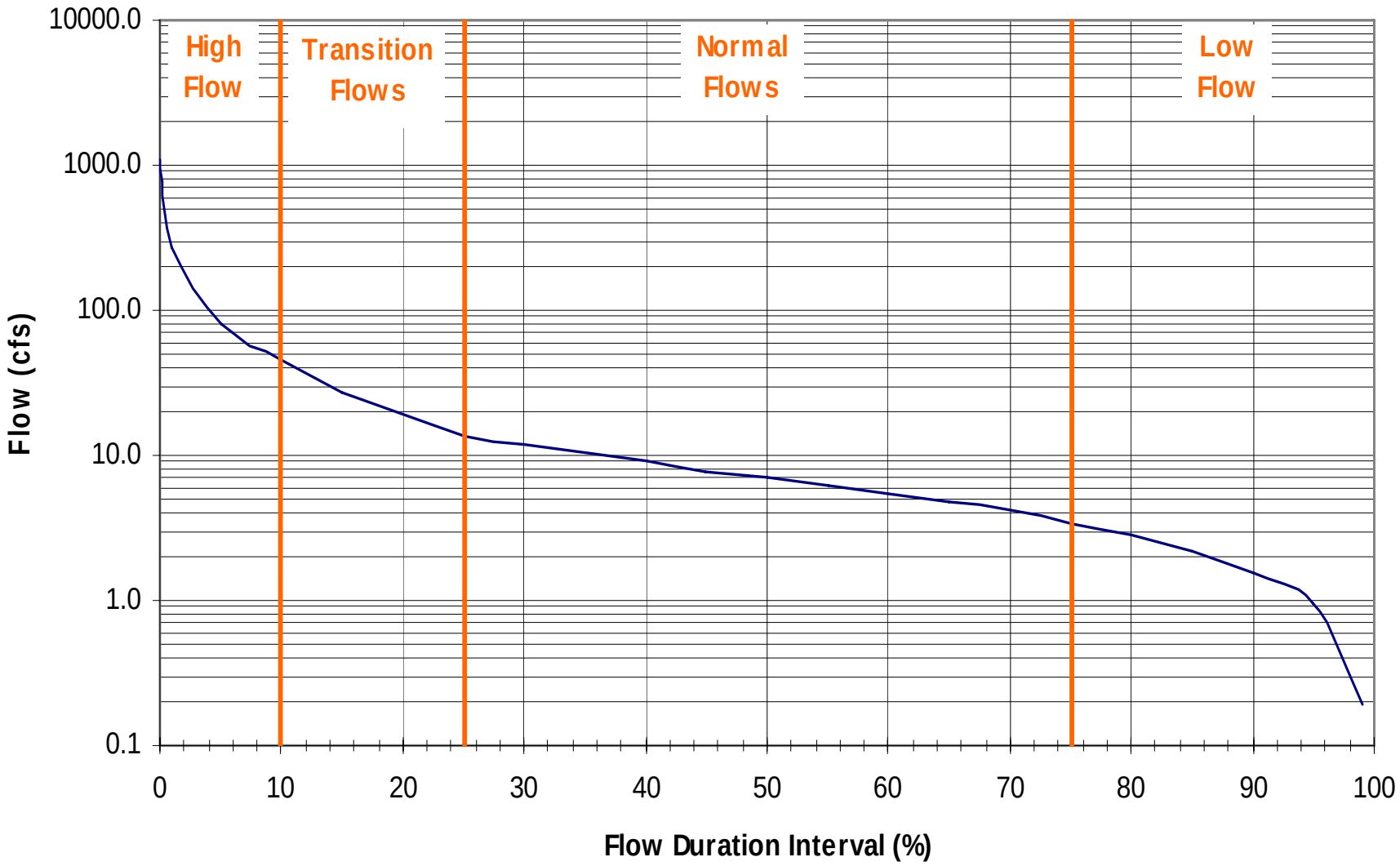
BST Results for Monitoring at Rt. 1

(DEQ Station 1ANEA002.89)



** Results presented are combined Prince William County and DEQ BST data. County data were collected in 2003-2004; DEQ data were collected in 2005-2006.*

Neabsco Creek
Flow Duration Curve

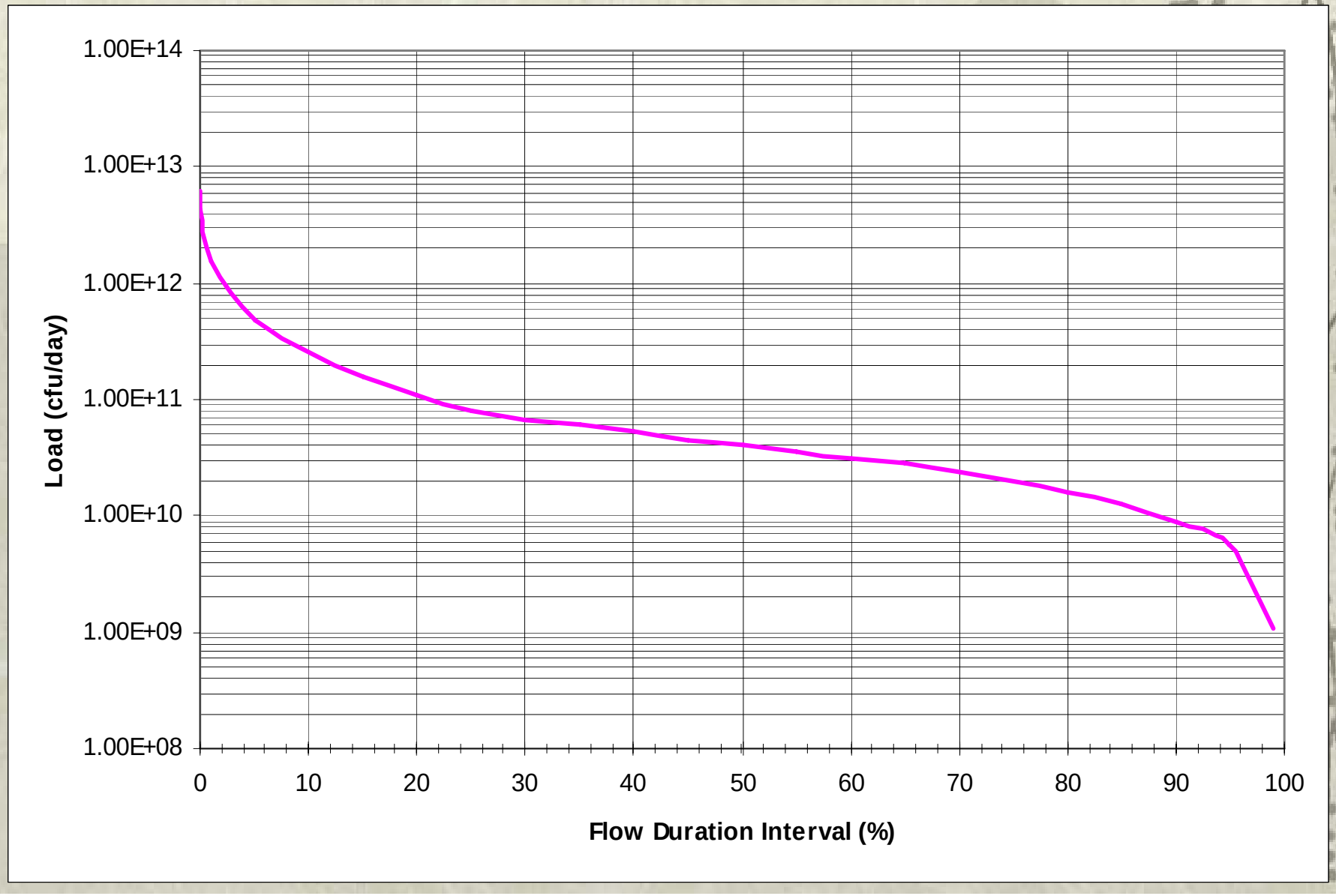


Neabsco Creek flows were computed from the USGS flow gage on Accotink Creek adjusting for drainage area.

Load Duration Curve

- Maximum Amount of Pollutant Allowed at Each Flow Level
- Multiply Flow Duration Curve by Water Quality Standard
- High Flows = More Assimilative Capacity
- Low Flow = Less Assimilative Capacity

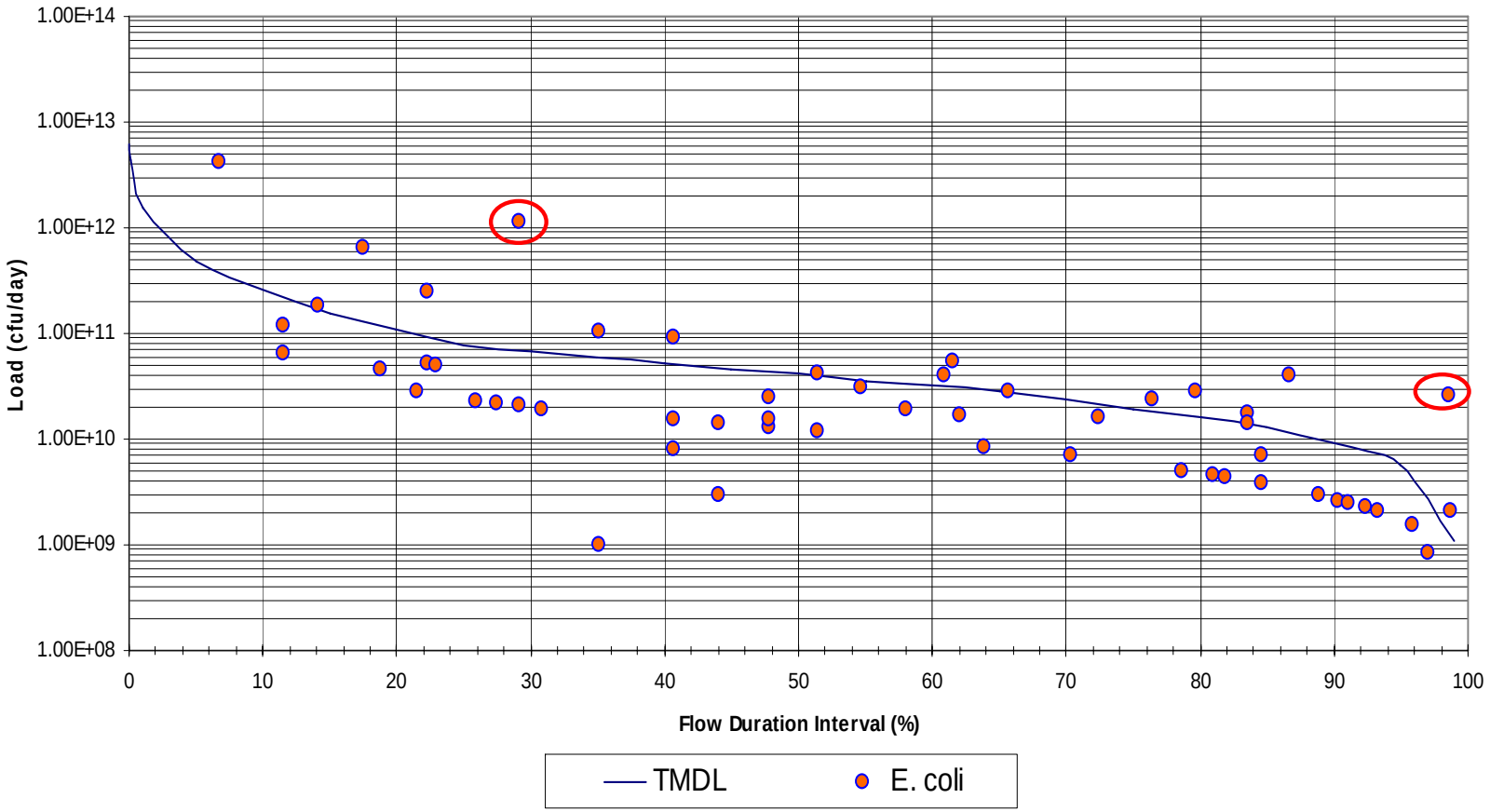
Neabsco Creek
Load Duration Curve



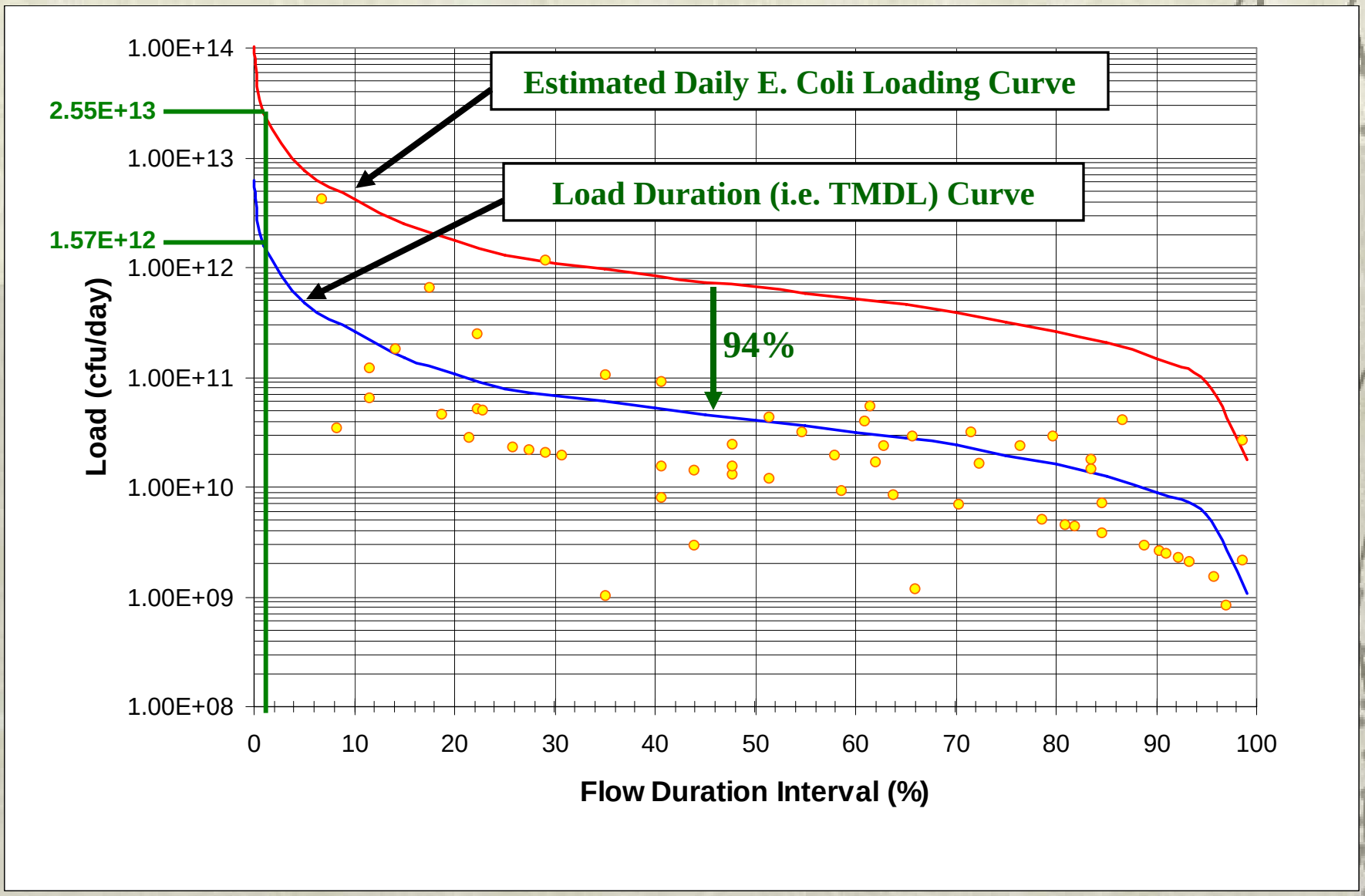
TMDL Required Reduction

- Ensure water quality is protected during times when stream is most vulnerable
- TMDL condition selected to reflect the flow-varying nature of bacteria impairments and based on in-stream data.
- In order to capture loadings under all flow conditions, the TMDL is determined for the 99th load percentile, i.e. for the 1% flow duration interval.

Neabsco Creek
Determining TMDL Reductions



TMDL Reduction



TMDL for Neabsco Creek

WLA	LA	MOS	TMDL
2.20×10^{11}	1.35×10^{12}	Implicit	1.57×10^{12}

- TMDL calls for a 94% reduction in bacteria loadings to meet WQS.
- BST results indicate the following contributions by source:
  - Human: 0%
  - Pets: 20%
  - Livestock: 1%
  - Wildlife: 79%

Key Issues

*** The watershed assessment supports the BST results in that pets and wildlife are the dominant categories.**

*** This is a wildlife dominant problem. Eliminating all other sources still would predict exceedances of the standard.**

*** While Virginia does allow streams to be redesignated for secondary contact recreation (which allows higher bacteria levels), the downstream portion of Neabsco Creek maintains the primary contact standard.**

*** Pet and other urban control measures will be necessary to reduce bacteria levels and make progress toward achieving goals.**

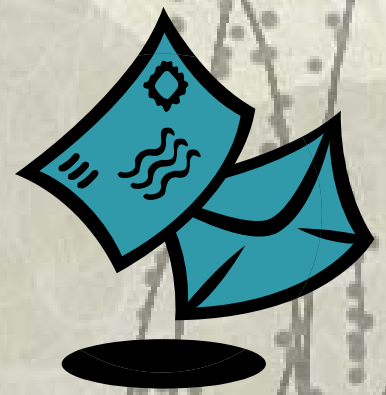
Stage I Implementation Goals

Load Reduction	94%	80%	70%	60%	Existing Load
Exceedance Rate	0%	7%	8%	10%	32%

- 60% reduction in source contributions should lead to a 10% exceedance rate of the e. coli criterion.
- 10% exceedance rate means the stream can be delisted from the §303(d) impaired waters list.
- E. Coli data from 2005 through current indicate a 14% exceedance rate of the criterion.

Next Steps

- **Public Comment Period for TAC Meeting from June 19 to July 19. Send all comments in writing to Katie Conaway (contact information on next slide).**
- **Public Meeting – will be held late July or early August. Draft TMDL Report will be presented.**
- **30 Day Public Comment Period following public meeting.**
- **Draft TMDL Report submitted to EPA for approval (late August, early September).**



CONTACTS

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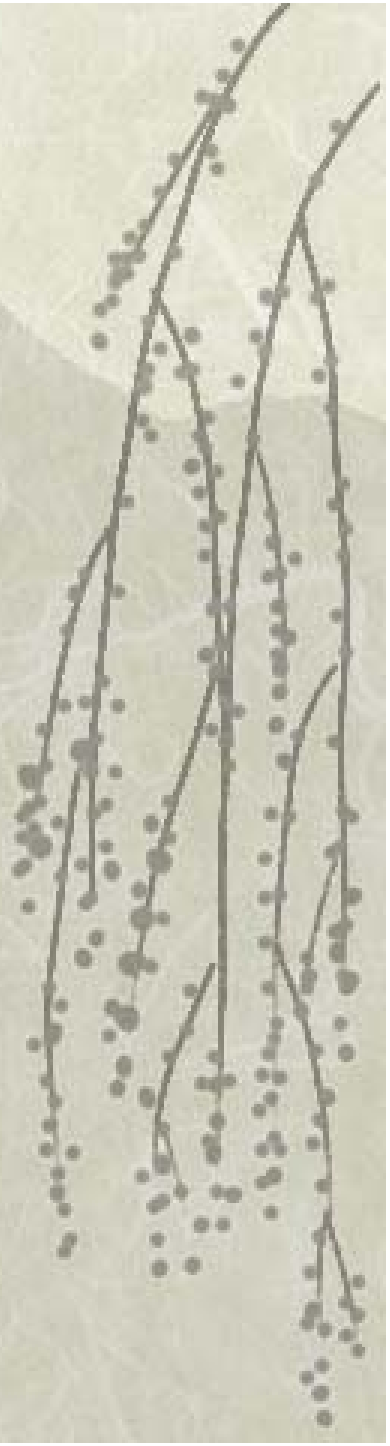

Neabsco Creek BST Data

Collector ID	Sample Date	Flow (cfs)	Flow Percentile	Fecal Coliform (cfu/100mL)	*E. coli* (cfu/100mL)	*Number of Isolates*	BST Distribution			
							Wildlife	Human	Livestock	Pet
PWC	7/9/2003	113.9	3.50	5280	2607	24	82%	0%	0%	18%
PWC	8/6/2003	6.5	53.5		260	24	78%	0%	0%	22%
PWC	9/5/2003	11.1	32.9		400	24	72%	0%	0%	28%
PWC	10/9/2003	5.7	59.3		140	24	70%	0%	0%	30%
PWC	11/5/2003	78.1	5.4		70	24	82%	0%	0%	18%
PWC	11/7/2003	48.2	9.6		1270	24	78%	0%	0%	22%
PWC	12/3/2003	10.4	35.1		30	24	82%	0%	0%	18%
PWC	1/7/2004	11.1	32.9		40	24	96%	0%	0%	4%
PWC	2/4/2004	37.1	11.8		95	24	96%	0%	0%	4%
PWC	3/2/2004	20.2	18.8		90	24	96%	0%	0%	4%
PWC	4/6/2004	11.7	30.8		235	24	79%	0%	0%	21%
PWC	5/5/2004	11.1	32.9		5680	24	71%	0%	0%	29%
PWC	6/2/2004	9.1	40.7		800	24	69%	0%	0%	31%
DEQ	7/20/2005	6.3	54.7	330	96	24	63%	0%	4%	33%
DEQ	8/24/2005	2.3	84.6	200	48	9	22%	0%	11%	67%
DEQ	9/27/2005	3.8	72.4	280	96	23	39%	9%	17%	35%
DEQ	10/26/2005	29.3	14.1		254	24	42%	4%	42%	12%
DEQ	11/29/2005	9.1	40.7		36	24	55%	33%	12%	0%
DEQ	12/21/2005	7.8	47.8		80	24	17%	25%	50%	8%
DEQ	1/24/2006	20.2	18.8		92	24	29%	0%	38%	33%
DEQ	2/21/2006	10.4	35.1		4	1	0%	0%	100%	0%
DEQ	3/28/2006	4.8	66.0		10	5	60%	0%	40%	0%
DEQ	4/19/2006	5.8	58.6		64	22	36%	5%	45%	14%
DEQ	5/9/2006	5.2	62.9		186	23	44%	9%	30%	17%
DEQ	6/21/2006	4.0	71.6		320	24	33%	4%	55%	8%

Annual Weighted Averages*			
BST Distribution			
Wildlife	**Human**	**Livestock**	**Pet**
79%	0%	1%	20%

* Distribution is adjusted for flow, e. coli and number of isolates.